G460

Multi-gas Detector

Operations Manual

GfG Instrumentation

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GfG Products for Increased Safety

Congratulations on your purchase of a high technology product from GfG – you have made an excellent choice!

Our detectors are characterized by reliability, safety, peak performance and economic efficiency. They comply with national and international directives.

This manual will help you operate the detector quickly and safely.

Please take note of these instructions before putting the device into operation!

If you have any questions, please feel free to contact us.

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Introduction

For Your Safety

Like any piece of complex equipment, the GfG G460 will do the job it is designed to do only if it is used and serviced in accordance with the manufacturer's instructions.

CAUTION: For safety reasons, this equipment must be operated and serviced by qualified personnel only. Read and understand the instruction manual completely before operating or servicing this device.

The warranties made by GfG with respect to the product are voided if the product is not used and serviced in accordance with the instructions in this manual. Please protect yourself and your employees by following them. The above does not alter statements regarding GfG's warranties and conditions of sale and delivery.

Application and Purpose

The G460 is a handheld detector for personal protection from atmospheric hazards. The detector measures continuously in diffusion mode and gives visual and audible alarms if a gas-induced danger arises. The G460 meets the following approval:

C US

Classified as intrinsically safe for use in
Class I, Division 1, Group A, B, C, and D
Hazardous locations Temp code T3
CSA C22.2 No. 152
ANSI / ISA-12.13.01-2000
UL 913

Design

Hook for carrying strap
Display
Keys
Diffusion inlets
Alarm LEDs
Horn
Contacts for accessories
Screw connectors for pump
Battery pack (accessible from back of unit)
17:55:26
ALARM1
%UEG
18.8
0.0
0
0
H2S
CO
PEAK
RESET
ZOOM
GFG

Operation

GfG recommends frequent verification of accuracy. The safest course of action is to verify accuracy with a known concentration of gas prior to each day's use. If the readings are less than 90% or greater than 120% (-10% to +20% accuracy) the detector must be calibrated before use.

In compliance with c-CSA (Canada) the following requirements must be observed:

CAUTION: Before each use, sensitivity must be tested on a known concentration of CO, H_2S and combustible gas (depending on which sensors are installed) equivalent to 25 to 50% of the full scale concentration. Accuracy must be within -0 to +20% of the actual measurement.

Accuracy may be corrected by performing an AutoCal® adjustment (see calibration).

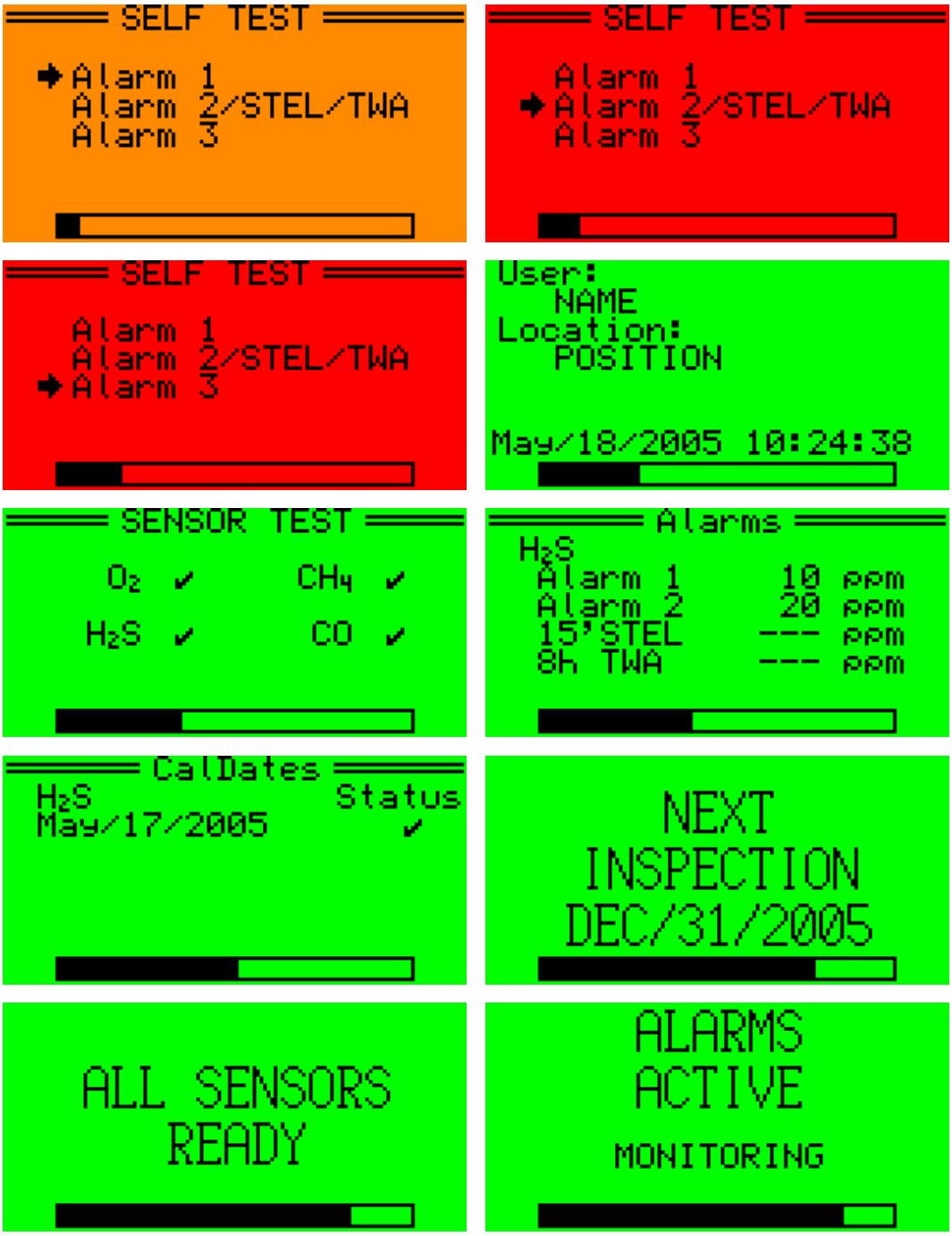
Detection Mode

Turning the Device On

Turn the G460 on in an environment known to be free from gases and / or vapors.

Press the right key to turn the G460 on.

After turning the G460 on, the display gives a short message about the detector, the user, the location (this message can be set in service mode). Should the date for the next inspection pass, the G460 gives an audible signal and the display reads "Inspection Overdue." The display also shows every gas being measured, its detection range and the set alarm thresholds.



NOTE: GfG recommends that you “bump check” the sensors before each day’s use to confirm their ability to respond to gas by exposing the detector to a gas concentration which will exceed the alarm set point of the sensors.

Turning the Device Off

To turn the G460 off, hold the right key (ZOOM) for approximately 5 seconds.

Display Illumination

Whenever you press a key or any alarm condition is activated, the display illumination turns on. It turns off automatically after approximately 10 seconds, or when the alarm condition is corrected.

Individual Gas Display / Rotating the Display

The display can be rotated 180° by pressing the right and the left keys simultaneously.

The G460 allows the user to store and display time-weighted averages (TWA), short-term exposure levels (STEL), peak values (MAX) and minimum values (MIN). The stored values have the following meanings:

STEL: The STEL (short-term exposure level) is the average value of the gas concentration over a period of time, which is determined by the short-term period. Short-term exposure levels are used to evaluate exposure peaks. The short-term period is typically set to 15 minutes.

TWA: The time-weighted average (TWA) is the average value of the gas concentration over an 8 hour working shift. For calculating the total dose, the G460 uses all gas levels measured since the detector was turned on.

MIN / MAX: Minimum and peak values measured since the detector was switched on or since the stored values were reset.

Press ZOOM briefly to view one gas at a time (ZOOM mode). Pressing ZOOM momentarily while in ZOOM mode will cycle to the next detected gas.

To read the stored values, press and hold the right key while in zoom mode. Press the key repeatedly to display all other measurement values and the battery capacity one after the other.

Example – Zoom Display for H_2S:

Top left:	Maximum value
Top right:	Actual gas concentration
Bottom left:	Short-term exposure level (STEL)
Bottom right:	Time-weighted average (TWA)

Battery

A fully charged G460 battery pack has a capacity of up to 25 hours of continuous operation in diffusion mode. The operational time may be reduced by sampling intervals or alarms. The remaining battery capacity is indicated by the battery symbol on the left side of the display. The black area represents the remaining capacity.

When the capacity falls to 4% power save mode is displayed and the G460 gives both a visual (red alarm LED and an “discharged” battery symbol in the display) and an audible warning.

Alarms

If the measured gas concentration exceeds a pre-set threshold, the detector immediately gives audible, visual and vibrating alarms. The display also indicates the exceeded alarm threshold which caused the alarm. A loud acoustic alarm (103 dB at 30 cm), bright flashing LEDs and a vibrating alarm warn of dangerous gas concentrations. In case of a gas alarm the whole display turns orange or red, depending on the gas concentration and the exceeded alarm threshold.

The G460 provides three instantaneous alarms for oxygen (O_2) and combustible gases (CH_4), and two alarms for toxic gases (CO, H_2S). The G460 warns the user of dangerous conditions caused by oxygen deficiency or enrichment and levels of combustible and toxic gases which exceeds the alarm threshold.

For toxic gases there is an additional alarm for exceeded time-weighted averages and short-term exposure levels (TWA and STEL).

Alarm Type	Sensors	Number of Alarms	Description
Instantaneous Value (AL)	Oxygen Combustible gases Toxic gases	3 3 2	An instantaneous alarm is activated immediately if the gas concentration exceeds or falls below a pre-set threshold. The alarm values are adjustable.
Short Term Value (STEL)	Toxic gases	1	The short-term value (STEL) is the average concentration over a short period of time (e.g. 15 minutes). The STEL alarm is not latching; it resets automatically as soon as the concentration falls below the threshold.
Long Term Value (TWA)	Toxic gases	1	The long-term value (TWA) refers to an 8-hour shift and calculates the average concentration. The TWA alarm cannot be reset. It is only de-activated if the detector is switched off.
Over Range	All	1	The screen will display ↑↑↑
Under Range	All	1	The screen will display ↓↓↓

Resetting Latching Alarms

When alarm 2 and 3 are set to latching you must reset an activated alarm by pressing the RESET key. Alarm 1 will automatically reset when the gas danger has passed.

If the detection range of the LEL sensor is exceeded, the display will read "↑↑↑", indicating it is over range, instead of a value for gas concentrations above 110% LEL. To protect the sensor from damage, the device turns off the sensor. However, the audible and visual alarms and the "↑↑↑" message remain active. The alarms must be reset by pushing the RESET key. The display will read: "Fresh air?" **If you have made sure that there is no combustible gas in the vicinity of the CH_4 sensor**, press yes to resume detection.

STEL, TWA, Maximum / Minimum Values

When you turn the G460 on, the unit begins to measure continuously in diffusion mode. All concentrations are shown on the display. In addition, short term and long-term averages (STEL and TWA) are calculated for toxic gases; for non-toxic gases peak and minimum values (MAX and MIN) are stored. The stored values can be read from the display by accessing the applicable display mode.

WARNING: To avoid possible personal injury, do not turn off the detector during a work shift. TWA, STEL and MAX readings are reset when the G460 is turned off.

Peak – Adjusting Peak Values

During peak mode (activated by pressing the left key PEAK), peak values can be monitored and displayed. The display shows an animated symbol in the bottom left corner.

Within *zoom display* the peak value will be displayed instead of the gas concentration.

Pressing RESET during peak mode will reset the peak memory to the current gas concentration. Pressing RESET during zoom display will reset the peak memory and the peak value memory to the current gas concentration.

By pressing PEAK again peak mode is deactivated.

Service Mode

Hold the middle key (RESET) for approximately 5 seconds to activate service mode. In the service mode the program parameters of the G460 can be adjusted and changed. A menu highlights the different adjustment possibilities. Several menu points require an access code (0011) to prevent accidental modification of important functions. In service mode all alarms are deactivated.
All adjustments in service mode are menu-controlled. The 3 keys stand for

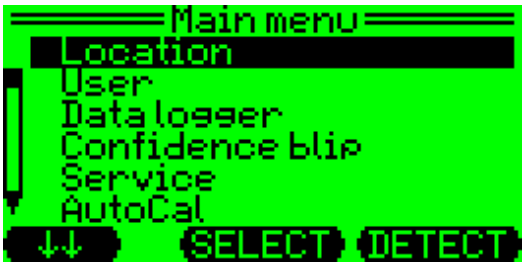
the function which is shown in the bottom line of the display. The main menu is displayed first when you enter service mode.

Main Menu

The menu points are:

1. **Location** (the physical location of the G460)
2. **User** (user identity)
3. **Datalogger** (adjust datalogger function)
4. **Confidence blip** (adjust intervals)
5. **Service** (start service menu)
6. **AutoCal®**
7. **Options** (adjust alarm volume and display contrast)

The keys' functions are explained in the bottom line of the display. In the main menu the keys have the following functions:

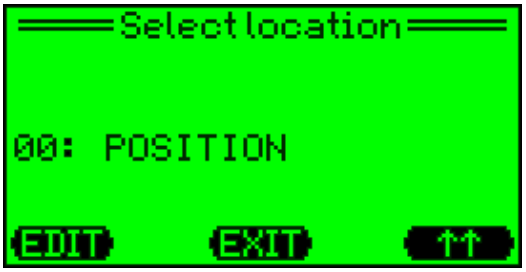


Left key (↓↓ scroll down)
Middle key (SELECT) select menu point
Right key (DETECT) back to detection mode

Location – Entering a Location

From a deposited table one location out of a hundred possible locations can be selected. The first two digits stand for the number of the table entry. With the exception of "00" all other 99 entries can only be edited with a PC. Within "00" up to 15 letters / figures can be entered, which will be stored as **operational place** in the G460. Entry is automatically completed when the cursor reaches the end mark (>).

When **Location** is selected by the middle key (SELECT), the following is displayed, and the keys have the following functions:



First a location number is specified:

EDIT - Change location name
EXIT - Back to main menu
↑↑ - Change location number

After selecting a location number (by pressing the right key – ↑↑) the location entry will be displayed. To change the location, press the left key (EDIT).

The following is displayed, and the keys have the following functions:

ABC↓↓ - Select symbol – move down
<<>> - Enter the blinking letter for figure and move the cursor to the right
012↑↑ - Select symbol - move up

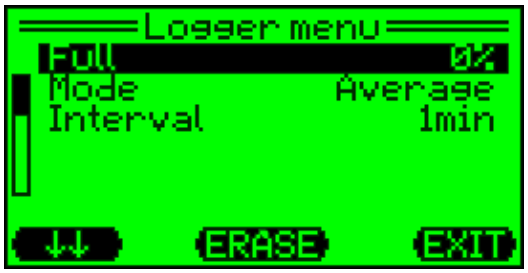
User – Entering User Name

From a deposited table one entry out of ten possible entries can be selected. The first two digits stand for the number of the table entry. Except for “00,” the other 9 entries can only be edited with a PC. Within “00” up to 15 characters can be entered, which will be stored as “**IDENTIFICATION**” in the G460. Entry is automatically completed when the cursor reaches the end mark (>). The entry process for user name (ID) is the same as that of the location entry.

EDIT - Change location name
EXIT - Return to main menu
↑↑ - Change identification number

Datalogger

Within the “**datalogger**” menu point different settings can be accessed:

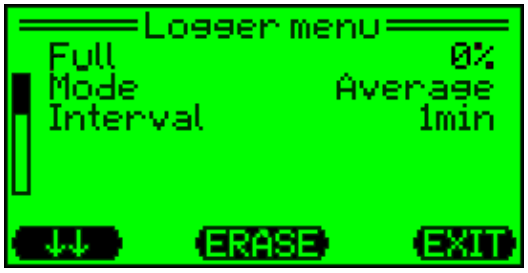


Full shows the used percentage of the datalogger memory

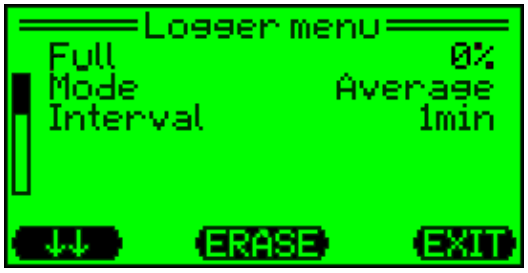
↓↓ - Jump to the next parameter

ERASE - Deletes data. A security prompt will appear (delete data?) → confirm with yes (right key), deny with no (left key)

EXIT - Back to main menu



If **Mode** is selected, the instantaneous value (Instant), average value (Average) or peak value (Peak) can be chosen with the left or right key.



If **Interval** is selected, the data recording interval can be set between 1 second and 60 minutes by pressing ↓↓ and ↑↑

Datalogger (sample screen shots)

GfG Data Download Software

File Device Edit View Options Window Help

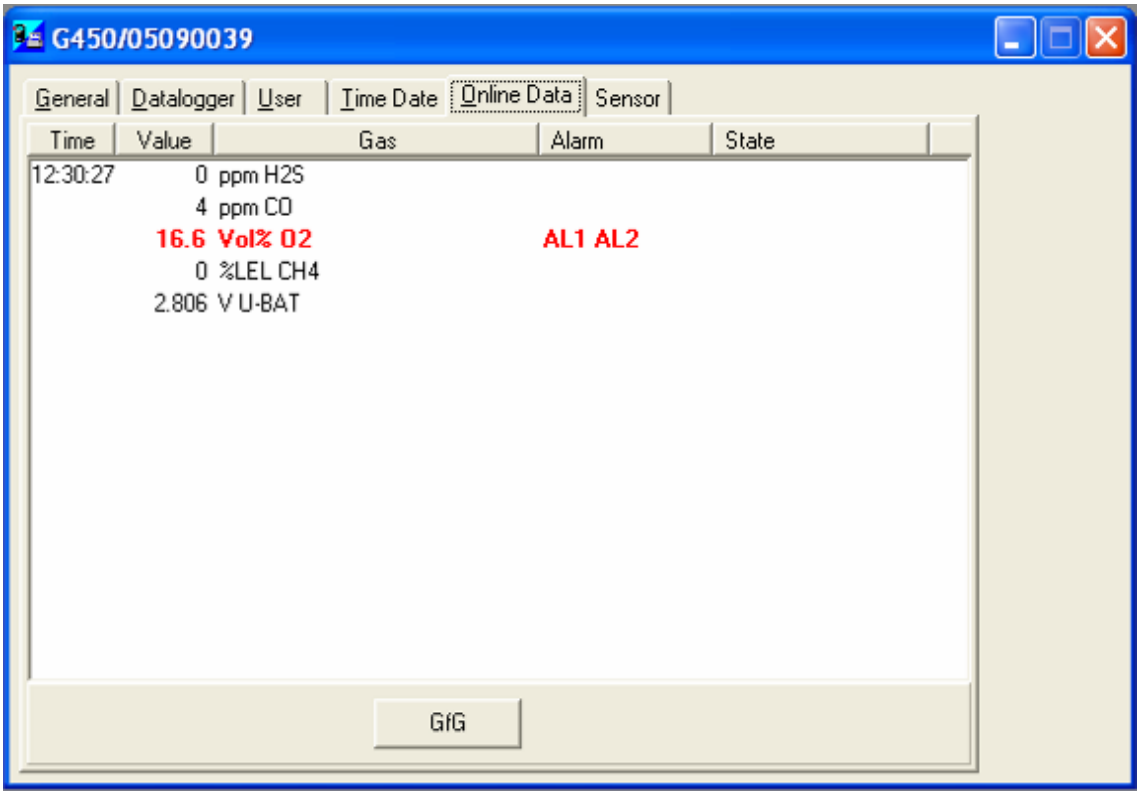
GfG42.tmp

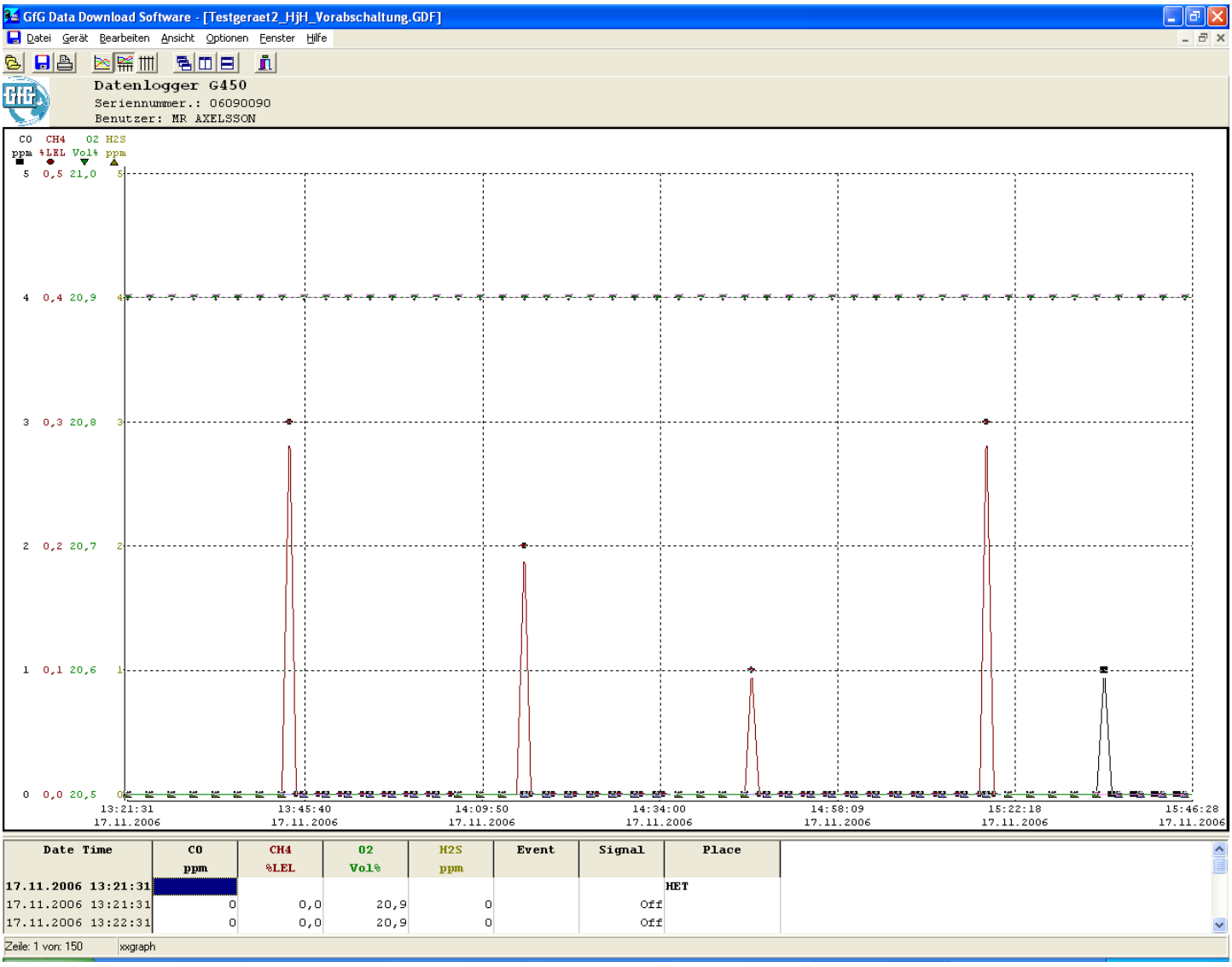
Datalogger G450
Serialno.: 05090039
User:

Date Time	CO ppm	CH4 %LEL	O2 Vol%	H2S ppm	Event	Signal
6/15/2000 12:30:49 PM	2	0.0	17.3	0		Off
6/15/2000 12:30:52 PM	2	0.0	17.4	0		Off
6/15/2000 12:30:55 PM	2	0.0	17.5	0		Off
6/15/2000 12:30:58 PM	0	0.0	17.6	0		Off
6/15/2000 12:31:01 PM	0	0.0	18.1	0		Off
6/15/2000 12:31:04 PM	0	0.0	18.8	0		Off
6/15/2000 12:31:07 PM	0	0.0	19.3	0		Off
6/15/2000 12:31:10 PM	0	0.0	19.4	0		Off
6/15/2000 12:31:13 PM	0	0.0	19.5	0		Off
6/15/2000 12:31:16 PM	0	0.0	19.6	0		Off
6/15/2000 12:31:19 PM	0	0.0	19.6	0		Off
6/15/2000 12:31:22 PM	0	0.0	19.7	0		Off
6/15/2000 12:31:25 PM	0	0.0	19.8	0		Off
6/15/2000 12:31:28 PM	0	0.0	18.9	0		Off
6/15/2000 12:30:14 PM						
6/15/2000 12:30:14 PM	0	0.0	18.9	0		Off
6/15/2000 12:30:17 PM	0	0.0	19.0	0		Off
6/15/2000 12:30:17 PM						
6/15/2000 12:30:17 PM	0	0.0	2.2	10		Off
6/15/2000 12:30:20 PM	0	0.0	2.0	10		Off
6/15/2000 12:30:23 PM	0	0.0	2.3	10		Off
6/15/2000 12:30:26 PM	0	0.0	2.8	9		Off
6/15/2000 12:30:29 PM	0	0.0	3.3	9		Off
6/15/2000 12:30:32 PM	0	0.0	3.4	9		Off
6/15/2000 12:30:35 PM	0	0.0	3.3	8		Off

G450/...

Line: 18 from: 106




GfG Data Download Software - [Testgeraet2_HjH_Vorabschaltung.GDF]
Datei Gerät Bearbeiten Ansicht Optionen Fenster Hilfe
Datenlogger G450
Seriennummer.: 06090090
Benutzer: MR AXELSSON
CO CH4 O2 H2S
ppm %LEL Vol% ppm
5 0,5 21,0
4 0,4 20,9
3 0,3 20,8
2 0,2 20,7
1 0,1 20,6
0 0,0 20,5
13:21:31 17.11.2006
13:45:40 17.11.2006
14:09:50 17.11.2006
14:34:00 17.11.2006
14:58:09 17.11.2006
15:22:18 17.11.2006
15:46:28 17.11.2006
Date Time | CO ppm | CH4 %LEL | O2 Vol% | H2S ppm | Event | Signal | Place
17.11.2006 13:21:31 | | | | | | | HET
17.11.2006 13:21:31 | 0 | 0,0 | 20,9 | 0 | | Off |
17.11.2006 13:22:31 | 0 | 0,0 | 20,9 | 0 | | Off |
Zeile: 1 von: 150
xxgraph

Confidence Blip

Within the Confidence blip menu point, the interval between confidence blips can be chosen.

The confidence blip can be heard in intervals of 15 to 90 seconds or be deactivated (- -).

↓↓ - Scroll down
SELECT - Confirm interval
EXIT - Return to main menu

AutoCal®

The AutoCal® menu point can be selected in the main menu or occurs automatically when the calibration adapter (Smart Cap) is connected.

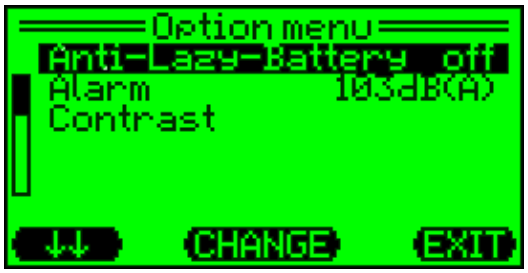
Within the AutoCal® menu point the device can be calibrated with fresh air (ZERO) or test gas (CAL).

AIR - AutoCal® with fresh air
GAS - AutoCal® with test gas
EXIT - Back to main menu

Options

Within Options you can adjust

- Anti-Lazy battery syndrome
- The buzzer volume (90 dB or 103 dB)
- The screen contrast: 1 (very low) up to 15 (very high)



↓↓ - Scroll down
CHANGE - Change selected parameter
EXIT - Back to main menu

Note: Rechargeable batteries inherently have a tendency to loose capacity over time. Some of this loss manifest itself as “voltage depresion” (aka Lazy Battery). With GfG’s advanced battery management technology, some of the lost capacity can be restored using the “Anti-Lazy Battery” feature. The overall battery life can be extended if this feature is used at least once every three months.

Service Menu

Enter the service menu by selecting **Service**. Within the service menu the G460 program parameters can be adjusted.

This menu point is only accessible with the code “0011.” The code prevents important functions from being changed by mistake or by unauthorized persons. In service mode all alarms are suppressed.

ABC↓↓ - Previous digit

<<>> - Enter (cursor moves automatically to the next position). By holding the key the last entry will be deleted and the cursor will move one position back.

012↑↑ - Next digit

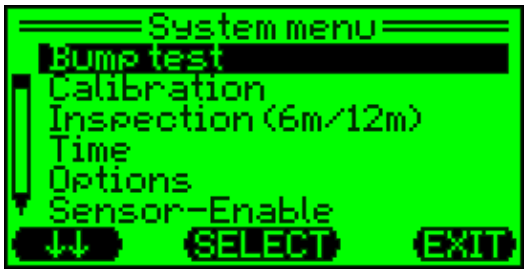
After entering code “0011,” you enter the service menu (see System Menu) and can perform general adjustments (zeropoint, span, alarms, calibration, etc).

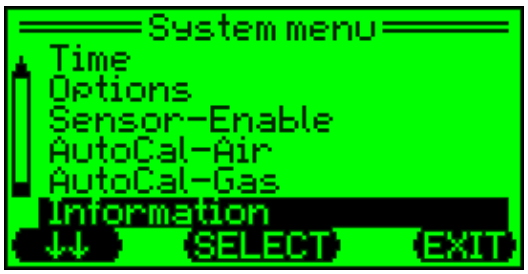
Select Sensors to adjust sensor-specific functions (alarms, calibration, etc).

DETECT - Back to detection mode

System Menu

Within the System menu the following adjustments are possible:





Bump Test - Date of next bump test

Calibration - Date of next calibration

Inspection - Date of next inspection

Time - Date and time

Options - Change language, vibrating alarm, latch and auto save settings

Sensor-Enable - Turn sensors on or off

AutoCal® - Air - Enable AutoCal® to zero specific sensors

AutoCal® - Gas - Enable AutoCal® to adjust the sensitivity of specific sensors

Information - Software version, instrument serial number, battery type, etc.

Bump Test

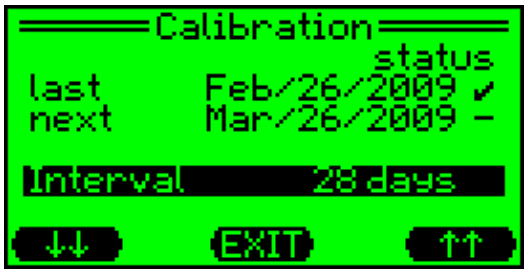
The date of the next bump test can be entered under the **Bump Test** menu. When the date arrives, the G460 will automatically sound an alarm. If the bump test date passes, the G460 will give a reminder every time it is switched on.

To change the interval:

↓↓ - Decreases value
EXIT - Confirms value
↑↑ - Increases value

Calibration

The date of the calibration can be entered under the **Calibration** menu. When the date arrives, the G460 will automatically sound an alarm. If the calibration date passes, the G460 will give a reminder every time it is switched on.



To change the inverval:

↓↓ - Decreases value
EXIT - Confirms value
↑↑ - Increases value

Inspection

The date of the next maintenance or inspection can be entered under the **Inspection** menu. When the date arrives, the G460 will automatically sound an alarm. If the inspection date passes, the G460 will give a reminder every time it is switched on.

>> - Moves to the next parameter
SELECT - Selects the blinking parameter
EXIT - Back to system menu

To change a parameter:
↓↓ - Decreases value
EXIT - Confirms value
↑↑ - Increases value

Time

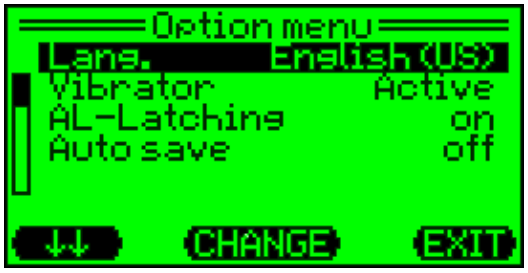
The time and date can be adjusted under the **Time** Menu.

>> - Moves to the next parameter
SELECT - Selects the blinking parameter
EXIT - Back to system menu

To change a parameter:
↓↓ - Decreases value
EXIT - Confirms value
↑↑ - Increases value

Options

In the **Options** menu point, the language can be changed, the vibrating alarm can be activated or deactivated and the latching and auto save features can be turned on or off.



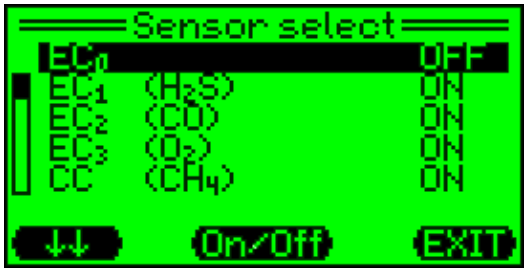
>>	-	Moves to the next parameter
SELECT	-	Selects the blinking parameter
EXIT	-	Back to system menu

Latching Alarm Function

The detector is shipped with the latching alarm function disabled. If the alarms are set to latch, the audible and visual alarms will persist until the alarm is acknowledged by pressing the center key (RESET). To enable latching alarms, press the left key (↓↓) until **Latching** is highlighted. Press the center key (CHANGE) to enable latching alarms.

Sensor – Enable

Each individual sensor can be activated or deactivated for each measurement. This function is necessary for applications in which a gas does not need to be measured or if the G460 will be upgraded with different sensors.

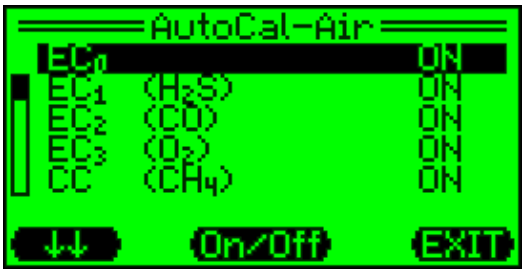


ON or OFF indicates the status of the sensor (active or inactive).

↓↓	-	Scroll down
On/Off	-	Turns sensor on or off
Exit	-	Return to system Menu

AutoCal® – Air

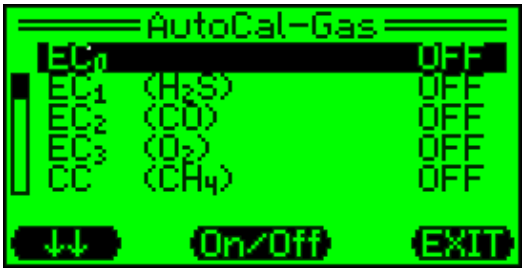
This menu point is to enable AutoCal® for sensors, using fresh air (zero calibration). Generally all sensors will be zero calibrated and show “ON.”



↓↓ - Scroll down to next sensor
On/Off - Calibration/non-calibration of sensor in AutoCal® program
Exit - Return to service Menu

AutoCal® – Gas

This menu point is to enable AutoCal® for sensors, using a test gas (gas calibration). Generally all sensors (except O_2) will be calibrated and show ”ON.”



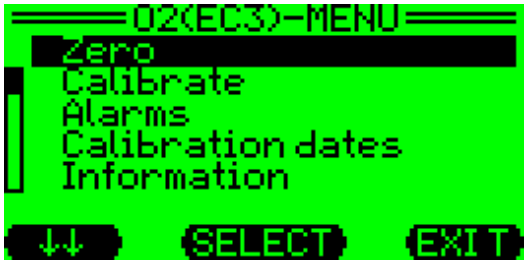
↓↓ - Scroll down to next sensor
On/Off - Calibration/non-calibration of sensor in AutoCal® program
Exit - Return to service Menu

Sensor Menu

The following functions refer to individual sensors in the G460. In the sensor menu each individual sensor can be selected. The adjustments are only valid for the selected sensor.

For a description of sensor-specific adjustments, the O_2 sensor is being used as an example. The adjustment options are the same for all sensors.

↓↓ - Move to next sensor
SELECT - Select sensor
Exit - Return to service Menu



For each sensor, the following adjustments can be made:

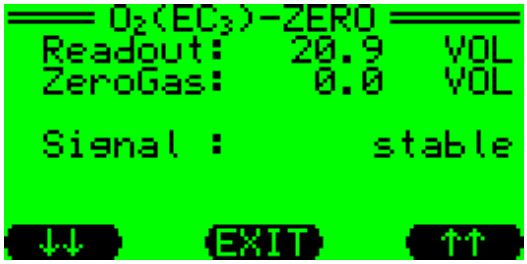
Zero	-	Adjust the zero point
Calibrate	-	Sensitivity calibration with test gas
Alarms	-	Adjust alarm thresholds
Calibration dates	-	View the date and status of the last calibration and zero
Information	-	View sensor information

↓↓	-	Move to next menu point
SELECT	-	Select menu point
EXIT	-	Return to service menu

Zeroing – Adjust Zero Point

To adjust the zero point, the sensor menu point Zero must be selected.

START	-	Start zero point adjustment
GAS	-	Enter zero gas concentration
EXIT	-	Back to “O2 menu”



After entering GAS the display reads:

↓↓	-	Zero gas value decreases by one unit
EXIT	-	Enter Value
↑↑	-	Zero gas value increased by one unit

NOTE: To set the zero point for oxygen, supply the unit with 100% nitrogen through a calibration adapter.

Calibration

During calibration, the sensitivity of the G460 is adjusted. Before starting calibration, make sure that the zero point adjustment has been done.

For calibration you need a suitable test gas, e.g.:

Detection Range	Test Gas
TOX	Carbon monoxide (CO), hydrogen sulfide (H_2S)
OX	Fresh air or test gas with 20.9% volume oxygen (O_2) in nitrogen (N_2)
EX	Methane (CH_4)

NOTE: Please call GfG for the correct calibration gas for your instrument.

To adjust sensitivity, the sensor menu point Calibrate has to be selected.

START - Start calibration
GAS - Enter calibration gas concentration
EXIT - Return to O_2 Menu

After entering GAS the display reads:

↓↓ - Decreases calibration gas value by one unit
EXIT - Saves value
↑↑ - Increases calibration gas value by one unit

Alarms – Adjust Alarm Thresholds

The G460 provides 3 alarm thresholds for each non-toxic gas (O_2, CH_4). For each toxic gas (H_2S, CO) the G460 provides 2 alarm thresholds. The alarms are triggered when the gas concentration exceeds or falls below the threshold. For toxic gases an additional alarm for exceeded long-term and short-term averages can be set.

After selecting the sensor menu point Alarms the following reading is displayed (here, for an O_2 sensor):

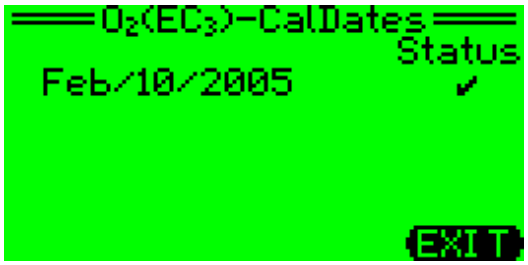
↓↓ - Scroll down
EDIT - Change alarm threshold
EXIT - Back to O_2 menu

After selecting the alarm thresholds by pressing EDIT (e.g.: Alarm 1), the value can be entered:

↓↓ - Decreases alarm value by one unit
EXIT - Back to Alarm menu
↑↑ - Increases alarm value by one unit

WARNING: If alarm points are set to off (--), the user will not be notified of an alarm condition. This could result in injury or death.

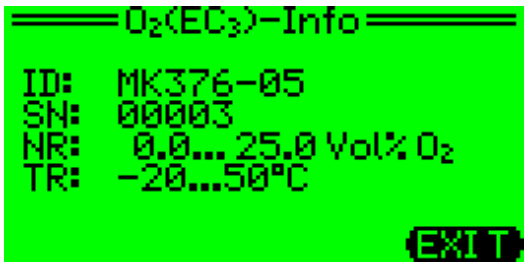
Calibration Dates



Within the sensor menu point Calibration dates, the date of the last calibration can be displayed, as well as if the calibration was successful (√) or not (✗).

Information

In this menu point, specific information for the sensor can be displayed:



Type of sensor (ID)	-	Type of sensor
Serial number (SN)	-	Serial number
Detection range (NR)	-	Detection range
Temperature range (TR)	-	Temperature range

CH4 Unit

A unit equipped with a CH_4 sensor has an additional Unit and gas menu point in which you can set the CH_4 sensor to detect in % LEL or % volume along with a variety of combustiable gases.

Activate Lights

The G460 provides an optional battery pack with lights. The lights can be switched on or off by holding down the left key for approximately 5 seconds. The lights are useful when the device is tied to a cord and lowered down into a sewer system. Using the lights can prevent the device from being dunked under water.

Replacing the Batteries and the Rechargeable Battery Pack Module

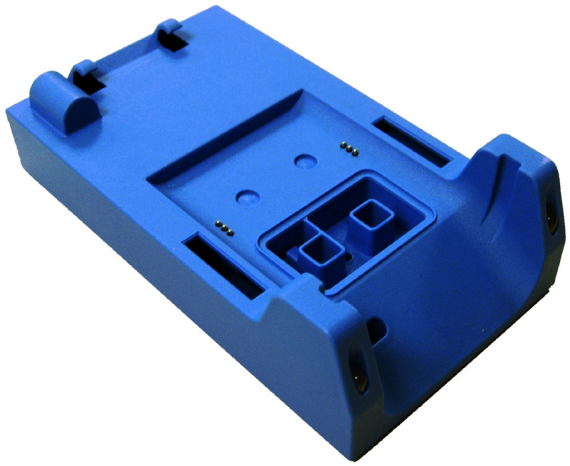
NOTE: **Batteries must not be replaced in hazardous locations. Replace only in non-hazardous locations.**

Turn the detector off before you replace the batteries. To replace the batteries or the supply module, unscrew the two screws on the front of the detector and pull the whole module backwards or insert the allen wrench through one of the screw holes to push the module backwards.

When the alkaline batteries have to be replaced, use a thin object to push the two battery cells out through the PCB holes. When inserting new batteries, check for the correct polarity (see plastic holder). Use only size AA batteries, Duracell MN1500 LR6. Secure the supply module by replacing the two screws.

Charging the Optional NiMH Battery Pack

WARNING: The detector must not be charged in a hazardous location. Only charge in non-hazardous atmospheres of 4 to 122°F (-20 to 50°C). Charge the detector using only the recommended charging adapter. Do not use any other charging adapter, as a fire or an explosion may result. Do not connect the charging adapter to voltages other than those used in North America, or an explosion may result.



The rechargeable G460 battery pack module can be charged with the GfG Drop-in Charger. The Drop-in Charger is also available as a vehicle charging unit. Make sure the maximum connected voltage does not exceed 30 V. To charge the G460, simply slide the device into the charging unit. The G460 will beep and then display either “quick charge” or “trickle-charge.” These two modes indicate the charge status of the G460. When the rechargeable battery pack is completely depleted, it will take approximately 6 hours to recharge in quick-charge mode. Then the Drop-in Charger will automatically switch to trickle-charge mode so that it is impossible to overcharge the battery pack. Both charging modes are indicated on the G460’s display. When the charger changes to trickle-charge mode, the battery pack has reached at least 80% of its capacity. An additional 2-3 hours of trickle-charge will fully charge the detector. The G460 will keep charging as long as it is plugged into the charger. Charging can be stopped by removing the G460 from the Drop-in Charger or by unplugging the charger.

Cleaning

The casing can be cleaned with a damp cloth. Never use solvents or detergents!

Maintenance and Inspection

Maintenance includes service, calibration and adjustment, as well as repair if it is necessary. Gas monitoring devices can react differently depending on environmental conditions. It is important, independent from maintenance duties, to test the device before putting it into operation each day. Bump testing before each use is highly recommended.

Service – Repair

WARNING: To avoid personal injury or damage to the detector, use only the specified replacement parts.

A function test must be executed before the first operation and at least once a year. This test comprises (depending on use and sensor exposure to poisons and contamination):

- Check zero point
- Charge battery (optional)
- Check pump (optional) and diffusion inlets
- Test display with standard test gas (bump test) and adjust, if necessary
- Check alarm signals
- Test response time

NOTE: GfG recommends that you “bump check” the sensors before each day’s use to confirm their ability to respond to gas by exposing the detector to a gas concentration which will exceed the alarm set point of the sensor.

Any G460 repair must be done according to the manufacturer’s instructions and with genuine spare parts. Return to GfG for proper service.

Accessories and Replacement Parts

			Part Number
Aspirator, hand (with wand)			7711-450
Batteries, alkaline (AA)			4002-001
Battery hardware kit (includes 6 screws and hex key)			4003-450
Battery pack, alkaline (without batteries) with vibrator			1450-202
Battery pack, rechargeable NiMH with vibrator			1450-211
Battery pack, rechargeable NiMH with vibrator and lights			1450-212
Cable, data downloading / USB interface (for PC)			1650231
Calibration adapter with tubing			7771-450
Calibration connector			1450225
Charger, plug-in (110 VAC) wall pack (for use with drop-in charger)			4001-650
Charger, vehicle			4001-650V
Crocodile clip			943450
Datalogging kit – alkaline (cable, software and drop-in cradle charger)			1450235
Datalogging kit – rechargeable (cable and software)			1450235R
Drop-in cradle charger (charge and data transfer)			1450220
Regulator, (for aluminum calibration gas cylinders) 0.5 lpm fixed flow rate with pressure gauge and on / off knob			2603-025
Regulator, (for steel calibration gas cylinders) 0.5 lpm fixed flow rate with pressure gauge and on / off knob			2603-020
Sensor - carbon monoxide, (CO)		0 - 500 ppm	1318232
Sensor - hydrogen sulfide, (H2S)		0 - 100 ppm	1318236
Sensor - methane, (CH_4) (combustible gases)		0 - 100 %LEL	1460710
Sensor - oxygen, (O_2)		0 - 25% volume	1318231
Sensor - COSH	CO H2S	0 - 300 ppm 0 - 100 ppm	1650730
Sensor - PID		0 - 2,000 ppm	1460704
Software, datalogging (CD only)			1450233

Spare parts and accessories should be stored at ambient temperatures of 32 to 86°F (0 to 30°C). Storage time should not be longer than 5 years. Electrochemical sensors should not be stored for more than 6 months. When you store oxygen sensors, be aware that storage reduces the expected lifetime of the sensor. When storing spare sensors, make sure that the ambient atmosphere is free from corrosive substances and sensor poisons.

Sensor Types and Detection Ranges

Warning: To avoid personal injury, use only sensors specifically designed for this detector.

Plug	Sensor Part Number	Detection Range	Gas	Resolution	T-Band*
EC1	1650730	0-500 ppm 0-100 ppm	Carbon monoxide (CO) Hydrogen sulfide (H2S)	1 ppm 0.5 ppm	±3 ppm ±0.2 ppm
	1460232	0-300 ppm	Carbon monoxide (CO)	1 ppm	±3 ppm
	1460235	0-1000 ppm	Carbon monoxide (CO)	1 ppm	±5 ppm
EC1	1460018	0-2000 ppm	Carbon monoxide (CO)	1 ppm	±4 ppm
EC2	1460231	0-25% volume	Oxygen (O_2)	0.1% volume	±0.3% volume
EC3	1460258	0-2000 ppm	Hydrogen (H_2)	2 ppm	±50 ppm
	1460260	0-1.00% volume	Hydrogen (H_2)	0.01% volume	±0.02% volume
	1460259	0-4.00% volume	Hydrogen (H_2)	0.01% volume	±0.05% volume
	1460236	0-100 ppm	Hydrogen Sulfide (H_2S)	0.1 ppm	±0.2 ppm
EC2 **EC3**	1460238	0-50 ppm	Nitrogen Dioxide (NO_2)	0.2 ppm	±0.6 ppm
PID/	1460703	0-500 ppm	Isobutylene (C_4H_8)	0.1 ppm	±0.2 ppm
EC2	1460704	0-2000 ppm	Isobutylene (C_4H_8)	0.5 ppm	±1.0 ppm
PL	1460710	0-100% LEL 0-100% LEL	Methane (CH_4) Propane (C_3H_8)	0.5% LEL 0.5% LEL	±2.5% LEL ±2.5% LEL
IR	1460780	0-5% volume	Carbon Dioxide (CO_2)	0.01% volume	-

* T-Band = Tolerance band

Sensor Specifications

MK211-6 Catalytic combustion sensor for combustible gases and vapors (GfG part number 1460710)		
Response time:		t_{90}: <30 seconds
Pressure	950 to 1,100 hPa:	Maximum ±5% of detection range or ±15% of display (1,013 hPa)
Humidity	5% to 90% r.h.:	Maximum ±5% of detection range or ±15% of display (55% r.h.)
Temperature	-4 to 122°F (-20 to +50°C):	Maximum ±3% of detection range or ±10% of display (68°F or 20°C)
Cross sensitivities at 50% LEL:		2.00Vol.% H2: approx.160%;0.70Vol.% C4H10: approx.72%; 2.20Vol.% CH4: 100%;0.70Vol.% C5H12: approx.71%; 0.85Vol.% C3H8: approx.85%;0.50Vol.% C6H14: approx.55%; The above information refers to the detection range for methane. It may vary from sensor to sensor and depends on the gas concentration and on the age of the sensor.
Expected lifetime:		3 years

MK222-2/-3 Photo-ionisation sensor for toxic combustible vapors Isobutylene i-C_4H_8 (GfG part number 1460703/1460704)	
Response time:	t_{90}: <30 seconds
Ionisation potential:	10.6 eV
Cross sensitivities:	Kerosene: approx.250%; C8H8: 250%; C7H8: 190%; C6H6: 190%; Diesel: approx.110; Benzine: approx.90%; C3H60: 83%; C8H18: 45%; C7H16: 40%; H2S: 30%; C6H14: 22%; NO: 14%; NH3: 11%; C5H12: 10%; C4H10=C3H8=CH4=H2=0%
Expected lifetime:	3 years

MK224-1 Infrared sensor for carbon dioxide CO_2(GfG part number 1460780)			
Response time		t_{50}: <20 seconds t_{90}: <60 seconds	
Pressure	800 to 1,200 hPa:	<1.7% of display per 1% pressure change	(refered to 1,000 hPa)
Humidity	0% to 90% r.h.:	Maximum ±0.10Vol% or ±10% of display	(refered to 50% r.h.)
Temperature	-4 to 122°F (-20 to +50°C):	Maximum ±0.10Vol% or ±10% of display	(refered to 68°F or 20°C)
Expected lifetime:		6 years	

MK348-5 Electrochemical sensor for nitrogen dioxide NO_2 (GfG part number 1318238)			
Response time		t_{90}: <30 seconds	
Pressure	800 to 1,200 hPa:	Maximum ±0.3 ppm or ±5% of display	(refered to 1,000 hPa)
Humidity	15% to 90% r.h.:	Maximum ±0.3 ppm or ±5% of display	(refered to 50% r.h.)
Temperature	-4 to 122°F (-20 to +50°C):	Maximum ±0.3 ppm or ±% of display	(refered to 68°F or 20°C)
Cross sensitivity:		Cl_2 ≈ 100%; H2S ≈ -8%; CO=SO_2=NO=0%	(*1)
Expected lifetime:		3 years	

MK369-5/-6 Electrochemical sensor for carbon monoxide CO (GfG part number 1318232)			
Response time		t_{50}: <10 seconds t_{90}: <30 seconds	
Pressure	800 to 1,200 hPa:	Maximum ±3 ppm or ±10% of display	(refered to 1,000 hPa)
Humidity	15% to 90% r.h.:	Maximum ±3 ppm or ±10% of display	(refered to 50% r.h.)
Temperature	14 to 104°F (-10 to +40°C):	Maximum ±3 ppm or ±10% of display	(refered to 68°F or 20°C)
Temperature	-4 to 122°F (-20 to +50°C):	Maximum ±3 ppm or ±15% of display	(refered to 68°F or 20°C)
Cross sensitivity:		H_2S<±3%; C_2H_4<60%; NO<35%; NO_2<10%; H_2<10%; SO_2=0%	(*1)
Expected lifetime:		3 years	

MK376-5 Electrochemical sensor for oxygen O2 (GfG part number 1318231)			
Response time:		t_{50}: <10 seconds t_{90}: <20 seconds	
Pressure	800 to 1,200 hPa:	Maximum ±0.2Vol.% or ±2.5% of range	(refered to 1,000 hPa)
Humidity	15% to 90% r.h.:	Maximum ±0.2Vol.% or ±2.5% of range	(refered to 50% r.h.)
Temperature	-4 to 122°F (-20 to +50°C):	Maximum ±0.5Vol.% or ±2.5% of display	(refered to 68°F or 20°C)
Expected lifetime:		3 years	

MK380-5 Electrochemical sensor for carbon monoxide CO and hydrogen sulfide H_2S (COSH) (GfG part number 1650730)			
Response time:		t_{50}: <15 seconds t_{90}: <45 seconds	
Pressure	800 to 1,200 hPa:	Maximum ±3ppm or ±7% CO reading or ±10% CO reading	(refered to 1,000 hPa)
Humidity	15% to 90% r.h.:	Maximum ±3ppm or ±7% CO reading or ±10% CO reading	(refered to 50% r.h.)
Temperature	-4 to 122°F (-20 to +50°C):	Maximum ±3ppm or ±15% display	(refered to 68°F or 20°C)
Cross sensitivities CO-portion:		H_2S ≈ 0..40%; H_2 ≈ 20%; SO_2<20%; NO_2<2%; NO<0.3%; Cl_2=0% (*1)	
Cross sensitivities H_2S-portion:		CO<2%; NO_2 ≈ -20%; SO_2 ≈ 8..20%; NO<3%; H_2≈ 0.03%; Cl_2=0% (*1)	
Expected lifetime:		3 years	

MK396-5 Electrochemical sensor for hydrogen H_2 (*2) (GfG part number 1318258)			
Response time:		t_{50}: <30 seconds t_{90}: <90 seconds	
Pressure	800 to 1,200 hPa:	Maximum ±10ppm or ±10% of display	(refered to 1,000 hPa)
Humidity	15% to 90% r.h.:	Maximum ±10ppm or ±10% of display	(refered to 50% r.h.)
Temperature	-4 to 122°F (-20 to +50°C):	Maximum ±20ppm or ±20% of display	(refered to 68°F or 20°C)
Cross sensitivities:		C_2H_4 ≈ 80%; NO ≈ 35%; HCN ≈ 30%; CO<20%; H_2S<20%; NO_2=SO_2=Cl_2=HCl=0% (*1)	
Expected lifetime:		2 years	

MK396-5 Electrochemical sensor for hydrogen H_2 (*2) (GfG part number 1318260)			
Response time:		t_{50}: <45 seconds t_{90}: <90 seconds	
Pressure	800 to 1,200 hPa:	Maximum ±0.01Vol% or ±10% of display	(refered to 1,000 hPa)
Humidity	15% to 90% r.h.:	Maximum ±0.01Vol% or ±10% of display	(refered to 50% r.h.)
Temperature	-4 to 122°F (-20 to +50°C):	Maximum ±0.02Vol% or ±20% of display	(refered to 68°F or 20°C)
Cross sensitivities:		NO_2 ≈ -400%; CO ≈ 150%; H_2S ≈ 20%; C_2H_4:n/d; NH_3=CO_2=Cl_2=SO_2=HCN=0 (*1)	
Expected lifetime:		2 years	

MK396-5 Electrochemical sensor for hydrogen H_2 (*2) (GfG part number 1318259)			
Response time:		t_{50}: <45 seconds t_{90}: <90 seconds	
Pressure	800 to 1,200 hPa:	Maximum ±0.01Vol% or ±10% of display	(refered to 1,000 hPa)
Humidity	15% to 90% r.h.:	Maximum ±0.01Vol% or ±10% of display	(refered to 50% r.h.)
Temperature	-4 to 122°F (-20 to +50°C):	Maximum ±0.02Vol% or ±25% of display	(refered to 68°F or 20°C)
Cross sensitivities:		H_2S ≈ 220%; C_2H_4:n/d; NH_3=CO_2=CO=Cl_2=HCN=NO=NO_2=0 (*1)	
Expected lifetime:		2 years	

MK429-5/-6 Electrochemical sensor for hydrogen sulfice H_2S (GfG part number 1318236)			
Response time:		t_{50}: <15 seconds t_{90}: <45 seconds	
Pressure	800 to 1,200 hPa:	Maximum ±2ppm or ±10% of display	(refered to 1,000 hPa)
Humidity	15% to 90% r.h.:	Maximum ±2ppm or ±10% of display	(refered to 50% r.h.)
Temperature	14 to 104°F (-10 to +40°C):	Maximum ±2ppm or ±10% of display	(refered to 68°F or 20°C)
Temperature	-4 to 122°F (-20 to +50°C):	Maximum ±2ppm or ±15% of display	(refered to 68°F or 20°C)
Cross sensitivities:		SO_2≈ 20%; NO_2<-20%; CO<1%; NO<0,2%; H_2<0,1%; (*1)	
Expected lifetime:		3 years	

(*1) Displayed value with reference to the supplied gas concentration
(*2) Not approved for LEL monitoring for applications of primary explosion protection

Technical Data

Type:		G460
Detection principle:		Electrochemical (EC): toxic gases and oxygen Catalytic combustion (CC): combustible gases and vapors (up to 100% LEL) Infrared (IR): Carbon dioxide
Detection range:		See Sensor Type and Detection Range
Response time t_{90}:		See Sensor Specifications
Expected sensor life:		3 years
Gas supply:		Diffusion
Display:		Illuminated full-graphic LCD, automatic size adjustment for optimal read out, battery capacity display, gas concentration as instantaneous and peak value
Alarm:		Depending on gas type; 2 or 3 instantaneous and 2 dosimeter alarms, low battery alarm Visual and audible warning and display indication, coloring of display depending on alarm status (orange/red) Buzzer: 103 dB (can be restricted to 90 dB)
Climate conditions:		
	for operation:	-4 to 122°F (-20 to +55°C) / 5 to 95% r. F. / 70 to 130 kPa
	for storage:	-13 to 122°F (-25 to +50°C) / 5 to 95% r. F. / 70 to 130 kPa (recommended 32 to 86°F (0 to +30°C)
Zero point and sensitivity calibration:		Manual or automatic with calibration program
Operational time:		Up to 25 hours
Power supply:		1. NiMH battery module, rechargeable Im=1 A (maximum charging current) Um=30 VDC (maximum voltage) or 2. Alkaline battery module, non-rechargeable with 2x size AA Duracell MN1500 LR6
Casing:		
	Material:	Rubberized plastic
	Dimensions:	4.3x3.0x2.2 inches (110x75x55 mm) (HxWxD)
	Weight:	10.23 oz. (290 g)
	Protection:	IP 67
Approvals:		
	CSA Approval:	cCSAus Class I, Division 1, Group A, B, C and D Hazardous locations Temp code T3 CSA C22.2 No. 152 ANSI / ISA-12.13.01-2000

Caution

- Substituting components may hinder intrinsic safety.
- For safety reasons, this equipment must be operated and serviced by qualified personnel only. Read and understand the user manual completely before operating or servicing this device.
- Do not use the detector if it is damaged. Before you use the detector, inspect the case. Look for cracks or missing parts.
- If the detector is damaged or something is missing, contact GfG Instrumentation, Inc. immediately.
- Calibrate the detector before first-time use and then on a regular schedule, depending on use and sensor exposure to poisons and contaminants.
- GfG recommends that you “bump test” the sensors before each use to confirm their ability to respond to gas. To do this, expose the detector to a gas concentration that exceeds the alarm set points. Manually verify that the audible and visual alarms are activated. Calibrate if the readings are not within the specified limits.
- It is recommended that the combustible sensor be checked with a known concentration of calibration gas after any known exposure to catalyst contaminants/poisons (sulfur compounds, silicon vapors, halogenated compounds, etc).
- The combustible sensor is factory calibrated to 50% LEL methane. If monitoring a different combustible gas in the % LEL range, calibrate the sensor using the appropriate gas.
- High off-scale readings may indicate an explosive concentration.
- Only the combustible gas detection portion of this instrument has been assessed for performance by CSA International.
- Protect the combustible sensor from exposure to lead compounds, silicones and chlorinated hydrocarbons. Although certain organic vapors (such as leaded gasoline and halogenated hydrocarbons) may temporarily inhibit sensor performance, in most cases the sensor will recover after calibration.
- For use only in hazardous locations where oxygen concentrations do not exceed 20.9% volume (v/v).
- Any rapidly increasing reading followed by a declining or erratic reading may indicate a gas concentration beyond the upper scale limit, which may be hazardous.

- Extended exposure of the G460 to certain concentrations of combustible gases and air may stress detector elements, which can seriously affect the device's performance. If an alarm occurs due to a high concentration of combustible gases, recalibration should be performed, or if needed, the sensor replaced.
- Do not test the combustible sensor's response with a butane cigarette lighter; doing so can damage the sensor.
- Do not expose the detector to electrical shock and/or severe continuous mechanical shock.
- Do not attempt to disassemble, adjust or service the detector unless instructions for that procedure are contained in the manual and/or that part is listed as a replacement part.
- Electromagnetic interference (EMI) signals may cause incorrect operation of this detector.

Warranty

GfG Instrumentation warrants our products to be free from defects in material and workmanship when used for their intended purpose, and agrees to remedy any such defect or to furnish a new part (at the option of GfG Instrumentation) in exchange for any part of any product that we manufacture that under normal use is found to be defective; provided that the product is returned, by the purchaser, to GfG's factory, intact, for our examination, with all transportation costs prepaid, and provided that such examination reveals, in our judgment, that it is defective.

This warranty does not extend to any products that have been subjected to misuse, neglect, accident, or unauthorized modifications; nor does it extend to products used contrary to the instructions furnished by us or to products that have been repaired or altered outside of our factory. No agent or reseller of GfG Instrumentation may alter the above statements.

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GfG Instrumentation
Worldwide Manufacturer of Gas Detection Solutions

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